

## ENVIRONMENTAL FACTORS THAT EXPLAIN VARIATION IN THE UPPER PERCENTILES OF SERUM DIOXIN CONCENTRATIONS IN A COMMUNITY IN MICHIGAN, USA

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### Introduction and Study Goals

The University of Michigan Dioxin Exposure Study (UMDES) has collected information based on questionnaires and samples of blood, dust and soil from selected subjects in Midland, Saginaw, Bay, Jackson and Calhoun counties. The distribution of the observed serum is right skewed, with a small number of high dioxin concentration values. From a public health perspective, it is important to learn the extremes (the upper quantiles) of the serum dioxin concentration. It is also critical to learn which environment factors can explain the variation in the upper percentiles of serum dioxin concentrations. This study seeks to estimate the upper percentiles of the serum dioxin concentrations, and better understand the environmental factors that are important in explaining the variations.

### Materials and Methods

In this study, a total of 946 subjects who have complete serum dioxin measures were included. Blood serum, house dust, and soil were analyzed by Alta Analytical Laboratory, Inc. Details of the serum, house dust, and soil sampling methods and analyses are reported elsewhere <sup>1,2,3</sup>. Additionally, the process of dealing with limit of detection issues for serum samples is reported elsewhere <sup>4</sup>. The outcomes of interest investigated included 2,3,7,8-TCDD and the serum dioxin concentration expressed as a Toxic Equivalent Quotient (TEQ).

The exposure information was obtained from the UMDES questionnaire <sup>5</sup>. The respondent was asked to recall possible dioxin exposure pathways over their entire lifetime. These pathways included a full residential history, occupations, property use, recreational activities, and consumption of meat, fish, game, eggs, milk, other dairy products, and vegetables. Basic demographic (age, gender, race, education, income) and health questions (height, weight, weight loss and gain, smoking status, pregnancy, childbearing and months of breastfeeding for each child) were also included. The function forms of all potential predictor variables are reported elsewhere <sup>6</sup>.

Population median and upper percentiles (95<sup>th</sup> and 99<sup>th</sup>) were investigated. Quantile regression was used to identify the important pathways of dioxin exposure and methods of elimination for the upper quantiles of dioxin concentration in serum. Two models were fit, one for the entire study sample and one for the control group, Jackson and Calhoun counties. The advantage of quantile regression is that it makes no distributional assumption about the error term in the model. All analyses were done using SAS 9.1 <sup>7</sup> and STATA 9.1 <sup>8</sup>.

### Results/Discussion

Results and discussion of the findings will not be available until after complete study results have been presented to the affected communities in August of 2006. Results of the complete short paper will include

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- Table 1 lists the median, 95<sup>th</sup> and 99<sup>th</sup> percentiles of serum dioxin TEQ and 2,3,7,8-TCDD in the entire study sample and in the Jackson and Calhoun counties.

Table 1: Median and upper percentiles of the overall population and the Jackson/Calhoun counties

Zone	N	TEQ			2,3,7,8-TCDD		
		Median	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	Median	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile
<b>Overall</b>	<b>946</b>						
<b>Jackson/Calhoun</b>	<b>251</b>						

- Figure 1 and Figure 2 represent fitted conditional quantiles of serum TEQ and 2,3,7,8-TCDD, including the median, computed for a regression model in age.
- Final models for the 95<sup>th</sup> percentile are displayed in Table 2 and Table 3.

Table 2: Estimated parameter and 95% confidence intervals for the 95<sup>th</sup> percentile TEQ model

Parameter	Estimate	95% Confidence Limits

Table 3: Estimated parameter and 95% confidence intervals for the 95<sup>th</sup> percentile 2,3,7,8-TCDD model

Parameter	Estimate	95% Confidence Limits

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